What is claimed is:

1. A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head.

2. The method of claim 1, wherein in step (a)(1) measuring performance of each head further includes the steps of measuring a record/playback performance of that head at one or more read/write frequencies.

3. The method of claim 1, wherein in step (a)(1) measuring performance of each head further includes the steps of measuring a record/playback performance of that head at multiple storage medium locations.

4. The method of claim 1, wherein in step (a)(1) measuring performance of each head further includes the steps of measuring a record/playback performance of that head according to a performance metric at different frequencies.

5. The method of claim 4, wherein said performance metric includes symbol error rate on track, symbol error rate off track, mean squared error on track, and mean squared error off track.

6. The method of claim 1, wherein step (a) is performed in a format design process and step (b) is performed in a test process.

7. The method of claim 6, wherein the format design process is part of storage device design phase and the test process is part of storage device manufacturing phase.

8. The method of claim 1, wherein step (a)(1) further includes the steps of calibrating each of said multiple data storage devices for each said frequencies.

9. The method of claim 1, wherein step (a)(2) further includes the steps of jointly selecting said frequencies and allocating said heads to said frequencies, to satisfy a specified constraint.

10. The method of claim 9, wherein:

step (a)(1) further includes the steps of, for each of said sample number of data storage devices:

selecting a performance metric for the heads in that data storage device for each zone; and

measuring performance of each head at different frequencies per zone based on said metric;

step (a)(2) further includes the steps of, for the multiple data storage devices:

based on said performance measurements, for each zone allocating an integral number of heads to each of said frequencies for that zone to satisfy

the specified constraint.

11. The method of claim 10, wherein in step (a)(2) allocating said heads to said frequencies per zone further includes the steps of: for each zone, based on the performance of the heads in a plurality of zones, allocating an integral number of heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

12. The method of claim 10, wherein step (a)(2) further includes the steps of:

based on said performance measurements, generating record/playback frequency capability distributions of the heads in the sample number of disk drives, at each zone for a target performance metric, and

based on said distributions, allocating an integral number of heads to each of said frequencies for that zone to satisfy said constraint for the said multiple data storage devices.

13. The method of claim 9, wherein said constraint comprises providing a required data storage capacity for each of said multiple data storage devices.

14. The method of claim 9, said constraint comprises providing a required data storage device yield for said multiple data storage devices.

15. The method of claim 9, wherein said constraint comprises maximizing the data storage device yield while providing a specified data storage device capacity of the multiple data storage devices.

16. The method of claim 9, wherein said constraint comprises maximizing the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield.

17. A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and based on said performance measurements, generating performance distributions of the heads in said sample number of data storage devices, at each zone for a target performance metric, and

(2) for said multiple data storage devices, based on said performance distributions, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head.

18. The method of claim 17, wherein generating said distributions further includes the steps of:

estimating record/playback frequency capability of each head based on said measurements, and

generating record/playback frequency capability distributions of the heads at each zone for a target performance metric based on said estimated record/playback frequency capabilities the heads.

19. The method of claim 17, wherein the steps of generating said distributions is performed in a post-processing phase.

20. The method of claim 17, wherein generating said distributions includes the steps of: generating record/playback frequency capability distributions of the heads based on said performance measurements at a target performance metric for the heads in said sample number of data storage devices.

21. The method of claim 17, wherein in step (a)(2) selecting said group of frequencies further includes the steps of selecting said group of frequencies to satisfy a specified constraint.

22. The method of claim 17, wherein said performance metric includes symbol error rate on track, symbol error rate off track, mean squared error on track, and mean squared error off track.

23. A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and for each zone allocating an integral number of heads to each of said frequencies for that zone to satisfy a constraint; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head and said allocation of the heads.

24. The method of claim 23, wherein step (b) further includes the steps of, for each of said multiple data storage devices:

(i) obtaining record/playback performance of each head at a performance metric per zone at one of said read/write frequencies;

(ii) for each zone, ranking the heads from best to worst according to the performance metric; and

(iii) assigning said allocated number of heads, according to the ranking, to one of said read/write frequencies.

25. The method of claim 24, further comprising the steps of:

repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

26. The method of claim 24, wherein steps (i)-(iii) are repeated for each of said frequencies, starting from the highest frequency to the lowest frequency.

27. The method of claim 24, wherein: step (ii) further includes the steps of selecting said performance metric for the heads in that data storage device for each zone.

28. The method of claim 23, wherein for each head in said multiple data storage devices, said number of zones are on different storage media in each data storage device.

29. The method of claim 23, wherein for each head in said multiple data storage devices, said number of zones are on the same storage media in each data storage device.

30. The method of claim 23, wherein in step (a)(2) said specified criteria comprises providing a specified data storage capacity for each of the multiple data storage devices while maximizing a data storage device yield.

31. The method of claim 23, wherein in step (a)(2) said specified criteria comprises maximizing the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield.

32. The method of claim 23, wherein step (b) further includes the steps of calibrating each data storage device for each frequency.

33. A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head;

wherein in each of said multiple data storage devices:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes the same number of concentric zones as other storage media in that data storage device, such that the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial locations.

34. The method of claim 33, wherein radially similarly situated zones on all the storage media include the same number of concentric tracks.

35. The method of claim 33, wherein at least a number of radially similarly situated zones on all the storage media include different number of concentric tracks.

36. A method of defining a storage format in multiple data storage devices, each data storage device having a plurality of storage media and a plurality of corresponding data transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, the method comprising the steps of:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said multiple data storage devices, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in each of said multiple data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head;

wherein in each of said multiple data storage devices:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes a sequence of concentric zones, such that the boundaries of at least a number sequentially similarly situated zones on different storage media in that data storage device are at different radial locations.

37. The method of claim 36, wherein sequentially similarly situated zones on all the storage media include the same number of concentric tracks.

38. The method of claim 36, wherein at least a number of sequentially similarly situated zones on all the storage media include different number of concentric tracks.

39. A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, and a controller that controls the heads for reading and writing data on the media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said data storage device, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in that data storage devices to each frequency in said group of frequencies per zone; and

(b) in said data storage device, assigning one of said frequencies to each head per zone, based on capability of that head, thereby defining said storage format.

40. The data storage device of claim 39, wherein in step (a)(1) measuring performance of each head further includes the steps of measuring a record/playback performance of that head according to a performance metric at different frequencies.

41. The data storage device of claim 39, wherein step (a) is performed in a storage device design phase and step (b) is performed in a storage device manufacturing phase.

42. The data storage device of claim 39, wherein step (a)(1) further includes the steps of calibrating each of said multiple data storage devices for each said frequencies.

43. The data storage device of claim 39, wherein step (a)(2) further includes the steps of jointly selecting said frequencies and allocating said heads to said frequencies, to satisfy a specified constraint.

44. The data storage device of claim 43, wherein:

step (a)(1) further includes the steps of, for each of said sample number of data storage devices:

selecting a performance metric for the heads in that data storage device for each zone; and

measuring performance of each head at different frequencies per zone based on said metric;

step (a)(2) further includes the steps of, for the multiple data storage devices:

based on said performance measurements, for each zone allocating an integral number of heads to each of said frequencies for that zone to satisfy the specified constraint.

45. The data storage device of claim 44, wherein in step (a)(2) allocating said heads to said frequencies per zone further includes the steps of: for each zone, based on the performance of the heads in a plurality of zones, allocating an integral number of heads to each of said frequencies for that zone to satisfy said constraint for said multiple data storage devices.

46. The data storage device of claim 44, wherein step (a)(2) further includes the steps of:

based on said performance measurements, generating record/playback frequency capability distributions of the heads in the sample number of disk drives, at each zone for a target performance metric, and

based on said distributions, allocating an integral number of heads to each of said frequencies for that zone to satisfy said constraint for the said multiple data storage devices.

47. The data storage device of claim 44, wherein said constraint comprises providing a required data storage capacity for each of said multiple data storage devices.

48. The data storage device of claim 43, said constraint comprises providing a required data storage device yield for said multiple data storage devices.

49. The data storage device of claim 43, wherein said constraint comprises maximizing the data storage device yield while providing a specified data storage device capacity of the multiple data storage devices.

50. The data storage device of claim 43, wherein said constraint comprises maximizing the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield.

51. A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, and a controller that controls the heads for reading and writing data on the media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and based on said performance measurements, generating performance distributions of the heads in said sample number of data storage devices, at each zone for a target performance metric, and

(2) for the data storage device, based on said performance distributions, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and allocating one or more of the heads in each of the multiple data storage devices to each frequency in said group of frequencies per zone; and

(b) in the data storage devices, assigning one of said frequencies to each head per zone, based on capability of that head.

52. The data storage device of claim 51, wherein generating said distributions further includes the steps of:

estimating record/playback frequency capability of each head based on said measurements, and

generating record/playback frequency capability distributions of the heads at each zone for a target performance metric based on said estimated record/playback frequency capabilities the heads.

53. The data storage device of claim 51 wherein the steps of generating said distributions is performed in a post-processing phase.

54. The data storage device of claim 51, wherein generating said distributions includes the steps of: generating record/playback frequency capability distributions of the heads based on said performance measurements at a target performance metric for the heads in said sample number of data storage devices.

55. The data storage device of claim 51, wherein in step (a)(2) selecting said group of frequencies further includes the steps of selecting said group of frequencies to satisfy a specified constraint.

56. A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, and a controller that controls the heads for reading and writing data on the media surfaces, the controller being programmed to write data in a storage format defined by the steps including:

(a) (1) for a sample number of data storage devices, measuring a performance of each head in the sample number of data storage devices at one or more read/write frequencies per zone, and

(2) for said data storage device, based on said performance measurements, jointly: selecting a group of read/write frequencies, two or more read/write frequencies for each zone, and for each zone allocating an integral number of heads to each of said frequencies for that zone to satisfy a constraint; and

(b) in said data storage device, assigning one of said frequencies to each head per zone, based on capability of that head and said allocation of the heads.

57. The data storage device of claim 56, wherein step (b) further includes the steps of, for the data storage device:

(i) obtaining record/playback performance of each head at a performance metric per zone at one of said read/write frequencies;

(ii) for each zone, ranking the heads from best to worst according to the performance metric; and

(iii) assigning said allocated number of heads, according to the ranking, to one of said read/write frequencies.

58. The data storage device of claim 57, wherein step (b) further comprises the steps of:

repeating steps (i)-(iii) for the remaining heads at the other read/write frequencies.

59. The data storage device of claim 57, wherein step (b) further includes the steps of selecting said performance metric for the heads in that data storage device for each zone.

60. The data storage device of claim 56, wherein in step (a)(2) said specified criteria comprises providing a specified data storage capacity for the data storage devices while maximizing a data storage device yield.

61. The data storage device of claim 56, wherein in step (a)(2) said specified criteria comprises maximizing the data storage capacity for each of the multiple data storage devices while providing a specified data storage device yield.

62. A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, and a controller that controls the heads for reading and writing data on the media surfaces, the controller being programmed to write data in said multiple zones, wherein:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes the same number of concentric zones as other storage media in that data storage device, wherein the boundaries of radially similarly situated zones on all the storage media in that data storage device are at the same radial locations.

63. The data storage device of claim 62, wherein radially similarly situated zones on all the storage media include the same number of concentric tracks.

64. The data storage device of claim 62, wherein at least a number of radially similarly situated zones on all the storage media include different number of concentric tracks.

65. A data storage device comprising a plurality of pairs of storage media surfaces and transducer heads, each transducer head for recording on and playback of information from a corresponding storage medium in multiple zones, and a controller that controls the heads for reading and writing data on the media surfaces, the controller being programmed to write data in said multiple zones, wherein:

said multiple zones on each storage media are arranged as concentric zones, each zone having an inner and an outer boundary at different radial locations on the storage media,

such that each storage media includes a sequence of concentric zones, such that the boundaries of at least a number sequentially similarly situated zones on different storage media in that data storage device are at different radial locations.

66. The data storage device of claim 65, wherein sequentially similarly situated zones on all the storage media include the same number of concentric tracks.

67. The data storage device of claim 65, wherein at least a number of sequentially similarly situated zones on all the storage media include different number of concentric tracks.